

Tuning Germanium Crystal Reflectivity and Mosaic

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Description:

The standard for performance in monochromatic scattering of neutrons and x-rays has been pyrolytic graphite crystals (PG). PG has the disadvantages of scattering higher order wavelengths and it has only two useful reflections (002 and 004) that limit flexibility in desired wavelength and resolution. If the properties of germanium crystals could be tuned so that the reflectivity performance is comparable or superior to PG, then germanium would replace PG for many applications with improved performance and flexibility, since it rejects higher order wavelength contamination and has a much larger range of useful lattice spacings than PG. NIST seeks a new processing technology to make the performance of germanium comparable to that of PG.

The main goal of this project is to find a manufacturing technique that can improve the scattering performance of germanium crystals. The NIST Center for Neutron Research would serve as the main bridge for this project by testing the germanium crystal performance.

Phase I would consist of completing feasibility tests to find a manufacturing technique that is promising. This means the production of germanium crystals with peak reflectivities comparable to those of pyrolytic graphite (0.6 and higher) and mosaics in the range 15' to 40'. The NCNR neutron scattering results from Phase I, will be published in open literature.

Phase II would consist of tuning the manufacturing process to obtain a commercial product.

NIST will provide assistance in the form of neutron beam time, at no-cost, at the NCNR, including staff assistance with data taking, analysis and discussion. The use of the NCNR under this subtopic is for non-proprietary research purposes where results are publishable and available to the general public in the literature.